SECTION 1: Product and Company Identification

1.1 Product identifier

Product name	:	Oxygen (compressed)
Trade name	:	No information.

1.2 Other means of identification

Chemical Name	:	Oxygen
Chemical Formula	:	O2

1.3 Recommended use and restrictions on use

Product use	:	Semiconductor Processes Industrial & Professional use Synthetic/Analytical chemistry Photovoltaic Processes

1.4 Details of supplier of the safety data sheet

Company identification	:	Iwatani Corporation (Singapore) Pte. Ltd.
Address	:	6 Shenton Way, OUE Downtown 2 #13-11, Singapore 068809
Phone	:	+65 6862 2111

1.5 Emergency contact

Emergency phone number	:	+65 6220 8347

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Physical hazards	:	Gases under pressure- compressed gas.
Characteristic	:	Oxidising gases.
Acute toxicity (inhalation)	:	Not classified.
Skin corrosion/irritation	:	Not classified.
Serious eye damage/eye irritation	:	Not classified.
Acute aquatic toxicity	:	Not classified.

2.2 GHS label elements, including precautionary statements

Pictogram(s) :

Signal word(s) : Danger

Hazard statement(s) : H270: May cause or intensify fire; oxidizer
H280 – Contains gas under pressure; may explode if heated

Precautionary statements

Prevention	:	P220 - Keep away from clothing and other combustible materials. P244 - Keep valves and fittings free from oil and grease.
Response	:	P370 + P376 - In case of fire: Stop leak if safe to do so.
Storage	:	P403 - Store in a well-ventilated place.
Disposal	:	None.

Emergency Overview	**WARNING! High-pressure, oxidizing gas. Vigorously accelerates combustion. Self-contained breathing apparatus may be required by rescue workers. Under ambient conditions, this is a colorless, odorless, and tasteless gas.**

2.3 Other hazards which do not result in classification

Inhalation hazard	:	Breathing 80% or more oxygen at atmospheric pressure for more than a few hours may cause nasal stiffness, cough, sore throat, chest pain, and breathing difficulty. Breathing oxygen at higher pressure increases the likelihood of adverse effects within a shorter time period. Breathing pure oxygen under pressure may cause lung damage and also Central Nervous System (CNS) effects resulting in dizziness, poor coordination, tingling sensation, visual and hearing disturbances, muscular twitching, unconsciousness, and convulsions. Breathing oxygen under pressure may cause prolongation of adaption to darkness and reduced peripheral vision.

SECTION 3. Composition/Information on ingredients

3.1 Substances / 3.2. Mixture

Substance name	Contents	CAS No.
Oxygen	100 %	7782-44-7

SECTION 4. First-aid measures

4.1 Description of first aid measures

Inhalation	:	Immediately remove victim to fresh air. If breathing stopped, give artificial respiration. Keep victim warm and at rest. Call a physician. Advise the physician that the victim has been exposed to a high concentration of oxygen.
Skin contact	:	Wash with water for at least 15 minutes while removing contaminated clothing. Seek immediate medical attention.
Eye contact	:	Flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Get medical attention if discomfort persists.
Ingestion	:	This product is a gas at normal temperature and pressure.

4.2 Most important symptoms/effect, acute and delayed

Continue inhalation of concentrations higher than 75% may cause nausea, dizziness respiratory difficulty and convulsion.

4.3 Indication of immediate medical attention and special treatment needed, if necessary
None.

SECTION 5. Fire-fighting measures

Oxidizing agent; vigorously accelerates combustion. Contact with flammable materials may cause fire or explosion.

5.1 Extinguishing media

Suitable extinguishing media	:	Vigorously accelerates combustion. Use media appropriate or surrounding fire. (e.g. Water spray or fog) is the preferred extinguishing method for clothing fires.
Unsuitable extinguishing media	:	Do not use water jet to extinguish.

5.2 Special hazards arising from the substance or mixture

Specific hazards	:	Heat of fire can build pressure in cylinder and cause it to rupture. Oxygen cylinders are equipped with a pressure with a pressure relief device. (Exceptions may exist where authorized by DOT.) No part of cylinders should be subjected to a temperature higher than 12°F (52°C). smoking, flames, and electric sparks in the presence of enriched oxygen atmospheres are potential explosion hazards.
Hazardous combustion products	:	None.

5.3 Advice for fire-fighters

Special fire fighting procedures	:	Evacuate all personnel from danger area. Immediately deluge cylinders with water from maximum distance until cool; then move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On site fire brigades must comply with OSHA 29 CFR 1910.156. In case of fire: Stop leak if safe to do so. Cool containers with water spray until well after fire is out. Stay away from ends of tanks. Stop flow of gas.
Special protective equipment for fire-fighters	:	In confined space use self-contained breathing apparatus. Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. Guideline: EN 469 - Protective clothing for firefighters. Performance requirements for protective clothing for firefighting. EN 15090 - Footwear for firefighters. EN 659 - Protective gloves for firefighters. EN 443 - Helmets for fire fighting in buildings and other structures. EN 137 - Respiratory protective devices - Self-contained open circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.

SECTION 6. Accidental release measures

WARNING! High-pressure, oxidizing gas.

6.1 Personal precautions, protective equipment and emergency procedures

Shut of flow if without risk. Ventilate area or move cylinder to a well-ventilated area.
Remove all flammable materials from vicinity. Oxygen must never be permitted to strike an oily surface, greasy clothes, or other combustible material.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so.

6.3 Methods and materials for containment and cleaning up

Methods for containment	:	Prevent further leakage or spillage if safe to do so. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.
Methods for cleaning up	:	Avoid heat, flames, sparks and other sources of ignition. Ventilate closed spaces before entering. Damaged cylinder(s) should be handled by trained personnel using pre-planned procedures.

SECTION 7. Handling and storage

7.1 Precautions for safe handling

Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps.
Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. Close cylinder valve after each use; keep closed even when empty. Never apply flame or localized het directly to any part of the cylinder.
High temperatures may damage the cylinder and could cause the pressure relief device to fail prematurely, venting the cylinder contents.

7.2 Conditions for safe storage, including any incompatibilities

Storage Conditions	:	Store in accordance with local regulations. Store and use with adequate ventilation, away from oil, grease, and other hydrocarbons. Separate oxygen cylinders from flammable by at least 20 ft (6.1m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53m) high and have a fire resistance rating of at least ½ hour. **Firmly secure cylinders** upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). store full and empty cylinders

separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

Incompatible materials : Keep away from combustible materials.

SECTION 8. Exposure controls/personal protection

8.1 Control parameters/Occupational exposure limits

None of the components have assigned exposure limits.

8.2 Appropriate engineering control measures

Local Exhaust. Use a local exhaust system, if necessary, to prevent increased oxygen concentration and, in welding, to keep hazardous fumes and gases below the applicable exposure limits in the worker's breathing zone.

Mechanical (General). General exhaust ventilation may be acceptable if it can maintain a supply of air that is not too rich in oxygen and, during welding, can keep hazardous fumes and gases below applicable TLVs in the worker's breathing zone.

8.3 Personal protection

Individual protection measures, such as personal protective equipment (PPE)		A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered: Protect eyes, face and skin from liquid splashes. PPE compliant to the recommended EN/ISO standards should be selected.
Hand protection	:	Wear appropriate protective chemical-resistant gloves that protect chemicals directly. Standard EN 388 – Protective gloves against mechanical risk.
Eye/face protection	:	Wear goggles with filter lenses selected as per ANSI Z49.1. Provide protective screens and goggles, if necessary, to protect others. Select as per OSHA 29 CFR 1910.33. for welding.
Skin or Body protection	:	Wear work gloves when handling cylinders; welding gloves for welding. Gloves must be free of oil and grease. Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. as needed for welding, wear hand, head, and body protection to help prevent injury from radiation and sparks. (see ANSI Z49.1) at a minimum, this includes welder's gloves and protective goggles, and may include arm protectors, aprons, hats, shoulder protection, as well as substantial clothing. Regardless of protective equipment, never touch live electrical parts. Wear safety shoes while handling containers. ISO 20345 - Personal protective equipment - Safety footwear.
Respiratory protection	:	None required under normal use. However, air-supplied respirators are required while working in confined spaces with this product. For welding, use air-purifying or air-supplied respirators, as appropriate, where local or general exhaust ventilation is inadequate. Adequate ventilation must keep exposure below applicable TLVs for fumes, gases, and other by-products of welding with oxygen. See sections 2 and 10for details. Respiratory protection must conform to OSHA 29 CFR 1910.134. select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

Hygiene measures : Ensure adequate ventilation.
Handle in accordance with good industrial hygiene and safety practice.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	:	Gas
Colour	:	Colourless.
Odour	:	Odourless.
Odour threshold	:	Not established.
pH	:	Not applicable.
Melting point	:	-218.79 °C (-361.82 °F)
Boiling point	:	-182.98 °C (-297.36 °F)
Flash point	:	-52.2 °C (-62 °F) TCC ASTM D56.
Critical Temperature	:	-118 °C (-180.4 °F)
Flammability (solid, gas)	:	Non-flammable.
Lower explosive limit	:	Not applicable.
Upper explosive limit	:	Not applicable.
Vapour pressure @ 20°C	:	Not applicable.
Vapour density at 21.1 °C (70°F) and 1 atm	:	0.0827 lb/ft^3 (1.325 kg/m^3)
Specific gravity (air=1) at 0°C (32°F) and 1 atm	:	1.105
Specific gravity (water=1) at boiling point	:	1.141
Molecular mass	:	32 g/mol
Solubility	:	Water 0.0489 vol/vol at 0°C (32°F)
Viscosity	:	No data available.
Partition coefficient: n-octanol/water	:	No data available.
Evaporation rate	:	Not applicable.
Decomposition temperature	:	Not applicable.
Autoignition temperature	:	Not applicable.

Section 10. Stability and reactivity

10.1 Reactivity

No reactivity hazard other than the effects described in sub-section below.

10.2 Chemical stability

Stable under normal conditions.

10.3 Possibility of hazardous reactions

Violently oxidises organic material.

10.4 Conditions to avoid

Violently oxidises organic material. Cylinders exposed to high temperatures or direct flame can rupture or burst.

10.5 Incompatible materials

Combustible materials, asphalt, flammable materials, especially oils and greases. Oxygen reacts with many materials. May react violently with reducing agents.
Violently oxidises organic material.
Consider the potential toxicity hazard due to the presence of chlorinated or fluorinated polymers in high pressure (>30 bar) oxygen lines in case of combustion.

10.6 Hazardous decomposition products

None known.

SECTION 11. Toxicology information

11.1 Information on toxicological effects

No known toxicological effects from this product.

Acute toxicity : The welding process may generate hazardous fumes and gases. (See sections 2,10, 15, and 16.) At atmospheric concentration and pressure, oxygen poses no toxicity hazards. At high concentrations, newborn premature infants may suffer delayed retinal damage (retrolental fibroplasias) that can progress to retinal detachment and blindness. Retinal damage may also occur in adults exposed to 100% oxygen for extended periods (24 to 48 hours) or at pressures exceeding atmospheric pressure, particularly in individuals whose retinal circulation has been previously compromised. All individuals exposed for long periods to oxygen at high pressure and all who exhibit overt toxicity should have ophthalmologic examinations.

At two or more atmospheres, CNS toxicity occurs. Symptoms include nausea, vomiting, dizziness or vertigo, muscle twitching, vision changes, and loss of consciousness and generalized seizures. At three atmospheres, CNS toxicity occurs in less than two hours; at six atmospheres, in only a few minutes.

SECTION 12. Ecological information

12.1 Ecotoxicity

No adverse ecological effects expected.

12.1 Persistence and degradability

Not applicable.

SECTION 13. Disposal information

13.1 Disposal methods

Disposal methods : Discharge, treatment, or disposal may be subject to national, state, or local laws. Never attempt to dispose off residual locally, return cylinders with residual to gas suppliers.

Contaminated packaging : Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Iwatani for proper disposal.

SECTION 14. Transport information

14.1 UN number

: UN1072

14.2 UN proper shipping name

: OXYGEN, COMPRESSED

14.3 Transport Hazard Class(es)

UNRTDG (United Nations Recommendations Transport Dangerous Goods)

Class : 2.2

Subsidiary risk : 5.1 – Oxidizing substances.

IATA-DGR (International Air Transport Association – Dangerous Goods)

Class : 2.2

Subsidiary risk : 5.1 – Oxidizing substances.

IMDG (International Maritime Dangerous Goods) – Code

Class : 2.2

Subsidiary risk : 5.1 – Oxidizing substances.

14.4 Packing group

Not assigned by regulation.

14.5 Environmental hazards

None.

14.6 Special precaution for user

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

Avoid transport on vehicles where the load space is not separated from the driver's compartment.

Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.

Before transporting product containers:

- Ensure there is adequate ventilation.
- Ensure that containers are firmly secured.
- Ensure valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.

SECTION 15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

Restrictions on use	:	None.
Other information, restriction and prohibition regulations	:	Ensure all national/local regulations are observed.
Applicable national regulations	:	Safety, health and environmental regulations/legislation specific for the substance or mixture are observed.

SECTION 16. Other information

16.1 Other information

Indication of changes	:	Ensure all national/local regulations are observed.
Disclaimer of liability	:	Before using this product in any new process or experiment, a thorough material combability and safety study should be carried out. Details given in this document are believed to be correct at the time of going to press. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use ca be accepted.

End of Safety Data Sheet